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Electromagnetic waves in an axion-active relativistic plasma non-minimally coupled to gravity

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Abstract

We consider cosmological applications of a new self-consistent system of equations, accounting for a non-minimal coupling of the gravitational, electromagnetic and pseudoscalar (axion) fields in a relativistic plasma. We focus on dispersion relations for electromagnetic perturbations in an initially isotropic ultrarelativistic plasma coupled to the gravitational and axion fields in the framework of isotropic homogeneous cosmological model of the de Sitter type. We classify the longitudinal and transversal electromagnetic modes in an axionically active plasma and distinguish between waves (damping, instable or running), and nonharmonic perturbations (damping or instable). We show that for the special choice of the guiding model parameters the transversal electromagnetic waves in the axionically active plasma, non-minimally coupled to gravity, can propagate with the phase velocity smaller than the speed of light in vacuum, thus displaying a possibility for a new type of resonant particle-wave interactions.

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